SPECIFICATION

TITLE OF THE INVENTION

RECEPTION SYSTEM AND DIGITAL BROADCASTING SYSTEM

BACKGROUND OF THE INVENTION

1.Field of the Invention

The present invention relates to a reception system and a digital broadcasting system.

2.Related Art of the Invention

As the development of digital video and audio technology using MPEG2, a digital multi-channel broadcasting based on a communication satellite has been already practically used. Referring to Fig. 9, the configuration of a digital broadcasting system of the conventional art will be described. Fig. 9 is a diagram showing the configuration of a digital broadcasting system 151 of the conventional art.

The digital broadcasting system 151 comprises a transmission system 102 which produces and transmits a transport stream, and a reception system 153 which receives the transport stream and outputs it to a display device 4 or a recording device 5. A satellite transponder 6 is a device which relays a radio wave, and mounted in a communication satellite 7.

Next, the configuration of the transmission system 102 of the conventional art will be described.

The transmission system 102 has a program selection relating data producing section 109, a packet multiplexing section 10, etc.

A coding section 8 has an MPEG2 video encoder which performs digital video compression coding, and an MPEG2 audio encoder which performs digital audio compression coding. Namely, the coding section 8 produces a packet stream consisting of packets having contents of a program, and outputs the packet stream to the packet multiplexing section 10.

The program selection relating data producing section 109 produces a packet stream consisting of a packet having program specific information (PSI), and a packet having service information (SI), and outputs the packet stream to the packet multiplexing section 10. The program specific information is configured by an NIT (Network Information Table), a PAT (Program Association Table), a PMT (Program Map Table), and the like, and the service information is configured by an SDT (Service Description Table), and EIT (Event Information Table), and the like. As described above, the program selection relating data producing section 109 produces a packet stream consisting of packets having contents of program selection relating data, and outputs the packet stream to the packet multiplexing section 10.

The packet multiplexing section 10 time division multiplexes the packet stream consisting of packets having contents of a program and supplied from the coding section 8,

and that consisting of packets having contents of program selection relating data and supplied from the program selection relating data producing section 109, into one transport stream.

A channel coding section 11 performs addition of an error correcting code, an interleave process, and addition of a synchronizing signal (framing) on the transport stream supplied from the packet multiplexing section 10. The interleave process is performed by changing the order of data transmission in the order of byte, in order to enhance the error correcting ability. The addition of a synchronizing signal is performed so as to provide a synchronization byte with periodicity, thereby enabling synchronization in the reception system 153 to be easily attained.

A modulating section 12 applies a modulation process due to quadrature phase shift keying (QPSK) modulation or the like, on a signal supplied from the channel coding section 11. A radio wave 147 is a transmitted radio wave.

Next, the configuration of the reception system 153 of the conventional art will be described.

The reception system 153 has a packet demultiplexing section 166, a stream sending section 172, etc.

A receiving section 13 receives a radio wave 148 which is transmitted from the satellite transponder 6.

A demodulating section 14 has a detector circuit which demodulates the radio wave 148.

A channel decoding section 15 restores the transport stream

in which the order of data transmission has been changed in the order of byte by the interleave process in the channel coding section 11, to the original transport stream, and performs error correction on the restored transport stream.

The packet demultiplexing section 166 has a PID filter 169, etc.

A PID designating section 178 can designate the PID of a packet having contents of a record program, to a record PID storing device 18. Also, the PID designating section 178 can designate an NIT PID (i.e., the PID of an NIT packet), to an NIT PID storing device 23. As described later, a record program is a program which is selected by external instructions.

The record PID storing device 18 receives a signal from the PID designating section 178, and stores the PID of a packet having contents of a record program.

The PID filter 169 extracts a packet having contents of a record program which is indicated by the record PID storing device 18, a packet having program specific information, and a packet having service information, from a transport stream which is output from the channel decoding section 15. However, the PID filter 169 has a function of allowing the packet having program specific information, and the packet having service information to pass therethrough without applying any process on the packets.

An output switching circuit 20 switches over the transport stream which is supplied from the PID filter 169, to an output

for displaying or that for recording.

An SIT (Selection Information Table) producing section 21 produces an SIT packet from the service information which is output from the PID filter 169.

The stream sending section 172 has an SIT packet replacing device 176, etc.

The NIT PID storing device 23 receives a signal from the PID designating section 178, and stores the NIT PID. As described later, an NIT packet is used as a replace packet which is replaceable with an SIT packet.

An SIT storing device 25 stores the SIT packet which is produced by the SIT producing section 21.

The SIT packet replacing device 176 can replace an NIT packet which is indicated by the NIT PID storing device 23, with the SIT packet which is output from the SIT storing device 25.

A packet modifying section 29 can receive a signal which is output from the SIT packet replacing device 176, and modify a packet to produce a record transport stream. The produced transport stream is output to the recording device 5.

A decoding section 27 has an MPEG2 video decoder which expands a compression coded video signal supplied from the output switching circuit 20, and an MPEG2 audio decoder which expands a compression coded audio signal supplied from the output switching circuit 20. Namely, the decoding section 27 expands a display transport stream which has compression coded contents

of a program, and outputs the expanded stream to the display device 4. A display transport stream consists of transport packets containing video and audio contents.

The display device 4 has a cathode ray tube which reproduces a video signal supplied from the decoding section 27, and a loudspeaker which reproduces an audio signal supplied from the decoding section 27.

The recording device 5 records a record transport stream which is output from the SIT packet replacing device 176.

The operation of the thus configured digital broadcasting system 151 of the conventional art will be described with reference to Fig. 10 also. Fig. 10 is a conceptual diagram illustrating steps of producing a record transport stream 196 from a transport stream 144 which is broadcast.

Hereinafter, the operation of the transmission system 102 of the conventional art will be described in detail.

The coding section 8 produces a packet stream consisting of packets 130 and 138 having contents of a program A, and a packet stream consisting of packets 131, 135, and 139 having contents of a program B, and outputs the packet streams to the packet multiplexing section 10.

The program selection relating data producing section 109 produces a packet stream consisting of a PAT packet 132, a PMT packet 137, an NIT packet 134, an SDT packet 136, and an EIT packet 133, and outputs the packet stream to the packet multiplexing

section 10.

The packet multiplexing section 10 multiplexes the packet stream supplied from the coding section 8, and the packet stream supplied from the program selection relating data producing section 109, to produce the transport stream 144. The transport stream 144 is then output to the channel coding section 11.

The channel coding section 11 performs addition of an error correcting code, an interleave process, and addition of a synchronizing signal on the transport stream supplied from the packet multiplexing section 10, and then outputs the transport stream to the modulating section 12.

The modulating section 12 applies a modulation process due to quadrature phase shift keying modulation, on the transport stream supplied from the channel coding section 11, and transmits the radio wave 147 from an antenna.

The satellite transponder 6 receives the radio wave 147, and then transmits the radio wave 148.

Next, the operation of the reception system 153 of the conventional art will be described in detail.

In response to external instructions, the reception system 153 selects the program A as a record program to start the receiving operation. Specifically, the reception system 153 receives the radio wave 148 from the satellite transponder 6, and refers information in the PAT in the transport stream of the radio wave, to detect the PMT. The PMT has the PIDs of packets for transferring

a stream relating to the program A. The PID designating section 178 recognizes the PIDs of the packets 130 and 138 having contents of the record program, and performs a signal output to the record PID storing device 18. The PID designating section 178 recognizes the PID of the NIT packet 134, and performs also a signal output to the NIT PID storing device 23.

The record PID storing device 18 receives the signal from the PID designating section 178, and stores the PIDs of the packets 130 and 138 having contents of the program A. The NIT PID storing device 23 receives the signal from the PID designating section 178, and stores the PID of the NIT packet 134.

The receiving section 13 receives the radio wave 148, and then outputs the radio wave to the demodulating section 14.

The demodulating section 14 outputs the transport stream which is obtained by demodulating the radio wave 148 received by the receiving section 13, to the channel decoding section 15.

The channel decoding section 15 performs error correction on the transport stream supplied from the demodulating section 14, restores the transport stream 144, and outputs the restored transport stream to the PID filter 169.

As described above, the record PID storing device 18 stores the PIDs of the packets 130 and 138 having contents of the program A. Therefore, the record PID storing device 18 can indicate the packets 130 and 138 having contents of the program A, to the PID filter 169.

The PID filter 169 extracts the packets 130 and 138 having contents of the program A which are indicated by the record PID storing device 18, from the transport stream 144 output from the channel decoding section 15. Furthermore, the PID filter 169 extracts the PAT packet 132, the PMT packet 137, the NIT packet 134, the SDT packet 136, and the EIT packet 133 from the transport stream 144 output from the channel decoding section 15.

The PID filter 169 then outputs the SDT and the EIT to the SIT producing section 21. Furthermore, the PID filter 169 outputs to the output switching circuit 20 a transport stream 195 consisting of the packets 130 and 138 having contents of the program A, the PAT packet 132, the PMT packet 137, the NIT packet 134, the SDT packet 136, and the EIT packet 133.

The SIT producing section 21 comprehends the SDT and the EIT supplied from the PID filter 169, produces SIT packets 141 and 142 from required service information, and outputs the SIT packets to the SIT storing device 25. The SIT storing device 25 outputs the SIT packets 141 and 142 supplied from the SIT producing section 21, to the SIT packet replacing device 176.

The output switching circuit 20 receives the transport stream 195 supplied from the PID filter 169.

If the output switching circuit 20 is set to the output for displaying, the output switching circuit 20 outputs the display transport stream to the decoding section 27. The display transport stream consists of the packets 130 and 138 having

contents of the program A which have been filtered with reference to information in the PMT.

The decoding section 27 expands the display transport stream supplied from the output switching circuit 20, and outputs a signal of the expanded stream to the display device 4.

The display device 4 receives the signal output from the decoding section 27, and reproduces an image and a sound constituting the program A.

If the output switching circuit 20 is set to the output for recording, the output switching circuit 20 outputs the transport stream 195 to the SIT packet replacing device 176.

As described above, the NIT PID storing device 23 stores the PID of the NIT packet 134. Therefore, the NIT PID storing device 23 can indicate the NIT packet 134 to the SIT packet replacing device 176.

The SIT packet replacing device 176 receives the transport stream 195 supplied from the output switching circuit 20. The SIT packet replacing device 176 replaces the NIT packet 134 indicated by the NIT PID storing device 23, with the SIT packet 141 supplied from the SIT storing device 25.

In this way, the SIT packet replacing device 176 performs replacement of the NIT packet 134 with the SIT packet 141, and then outputs the signal to the packet modifying section 29.

The packet modifying section 29 receives the signal output from the SIT packet replacing device 176, and selects only specific

information which correctly indicates the transport stream 195, whereby the PAT packet 132 is modified to a modified PAT packet 140, and the PMT packet 137 is modified to a modified PAT packet 143. The packet modifying section 29 discards the SDT packet 136 and the EIT packet 133.

In this way, the packet modifying section 29 produces a record transport stream 196, and outputs the stream to the recording device 5.

The recording device 5 receives the record transport stream 196 supplied from the packet modifying section 29, and records the transport stream.

In some cases, the transmission interval of an NIT packet is only about one time per 10 seconds depending on a broadcasting medium. This transmission interval is insufficient as the transmission interval for a replace packet which is replaceable with an SIT packet.

In the above, an NIT packet which is replaceable with the SIT packet 142 does not exist in the transport stream 195. Therefore, it is impossible to introduce the SIT packet 142 into the record transport stream 196. As a result, the SIT packet 142 is discarded.

SUMMARY OF THE INVENTION

The invention has been conducted in view of the problem. It is an object of the invention to provide a digital broadcasting

system characterized in that a replace packet which is replaceable with an SIT packet can be certainly ensured.

~~The 1st invention~~ one aspect of the present invention is a reception system comprising:

a receiving section which receives a transport stream transmitted from a transmission system that produces and transmits the transport stream, the transport stream being produced by multiplexing compression coded contents of a program, and electronic program guide information including program specific information having at least an NIT, a PAT, and a PMT, and service information having at least an SDT and an EIT;

a PID designating section which can designate a PID of a packet other than an NIT packet in the electronic program guide information, as a PID of a replace packet (hereinafter, referred to as replace PID);

a replace PID storing device which stores the replace PID;

an SIT producing section which produces an SIT packet from the service information in the received transport stream; and

a packet extracting and replacing section which can replace a replace packet indicated by said replace PID storing device, and the NIT packet with the SIT packet.

~~The 2nd invention~~ another aspect of the present invention is a reception system ~~according to 1st invention~~, wherein said transmission system produces a dummy packet for replacement, and inserts the dummy packet into the transport stream, and

said PID designating section designates a PID of the dummy packet (hereinafter, referred to as dummy PID) as the replace PID.

still another aspect

~~The 3rd invention~~ of the present invention is a reception system ~~according to 1st invention~~, wherein said transmission system produces interval information of the SIT packet, and transmits the interval information of the SIT packet with adding the interval information to the electronic program guide information, and

said PID designating section designates the replace PID with reference to the interval information of the SIT packet.

yet another aspect

~~The 4th invention~~ of the present invention is a reception system ~~according to 3rd invention~~, wherein the designated replace PID is a PID of a packet having contents of an unrecord program (hereinafter, referred to as unrecord PID), or an EIT PID or an SDT PID,

said packet extracting and replacing section includes a PID filter and an SIT packet replacing device, and said PID filter can extract a packet having the designated replace PID and contents of an unrecord program.

still yet another aspect

~~The 5th invention~~ of the present invention is a reception system ~~according to 1st invention~~, wherein said PID designating section designates a PID of a packet having contents of an unrecord program (hereinafter, referred to as unrecord PID), or an EIT PID or an SDT PID, and

said packet extracting and replacing section selects the replace packet from packets having the designated replace PID with reference to given interval information of the SIT packet, and actually replaces the selected packet with the SIT packet.

Another aspect

~~The 6th invention~~ of the present invention is a digital broadcasting system comprising:

a transmission system which produces and transmits a transport stream, the transport stream being produced by multiplexing compression coded contents of a program, and electronic program guide information including program specific information having at least an NIT, a PAT, and a PMT, and service information having at least an SDT and an EIT; and

a reception system having: a receiving section which receives the transport stream transmitted from said transmission system; a PID designating section which can designate a PID of a packet other than an NIT packet in the electronic program guide information, as a PID of a replace packet (hereinafter, referred to as replace PID); a replace PID storing device which stores the replace PID; an SIT producing section which produces an SIT packet from the service information in the received transport stream; and a packet extracting and replacing section which can replace a replace packet indicated by said replace PID storing device, and the NIT packet with the SIT packet.

A still further aspect

~~The 7th invention~~ of the present invention is a program recording medium which stores a program for causing a computer

to execute a whole or a part of the functions of the present invention ~~of a whole or a part of means according to any one of 1st to 6th inventions~~.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram showing the configuration of a digital broadcasting system which is described in Embodiment 1 of the invention.

Fig. 2 is a diagram showing the configuration of a transmission system which is described in Embodiment 1 of the invention.

Fig. 3 is a diagram showing the configuration of a reception system which is described in Embodiment 1 of the invention.

Fig. 4 is a conceptual diagram illustrating steps of producing a record transport stream which is described in Embodiment 1 of the invention.

Fig. 5 is a diagram showing the configuration of a digital broadcasting system which is described in Embodiment 2 of the invention.

Fig. 6 is a conceptual diagram illustrating steps of producing a record transport stream which is described in Embodiment 2 of the invention.

Fig. 7 is a diagram showing the configuration of a digital broadcasting system which is described in Embodiment 3 of the invention.

Fig. 8 is a conceptual diagram illustrating steps of

producing a record transport stream which is described in Embodiment 3 of the invention.

Fig. 9 is a diagram showing the configuration of a digital broadcasting system of the conventional art.

Fig. 10 is a conceptual diagram illustrating steps of producing a record transport stream in the conventional art.

[Description of the Reference Numerals and Signs]

1 digital broadcasting system

2 transmission system

3 reception system

4 display device

5 recording device

6 satellite transponder

7 communication satellite

8 coding section

9 program selection relating data producing section

10 packet multiplexing section

11 channel coding section

12 modulating section

13 receiving section

14 demodulating section

15 channel decoding section

16 packet demultiplexing section

17 first replace PID storing device

18 record PID storing device

19 PID filter

20 output switching circuit

21 SIT producing section

22 stream sending section

23 NIT PID storing device

24 second replace PID storing device

25 SIT storing device

26 SIT packet replacing device

27 decoding section

28 PID designating section

29 packet modifying section

51 digital broadcasting system

52 transmission system

53 reception system

59 program selection relating data producing section

66 packet demultiplexing section

67 first replace PID storing device

69 PID filter

72 stream sending section

74 second replace PID storing device

76 SIT packet replacing device

78 PID designating section

101 digital broadcasting system

102 transmission system

103 reception system

109 program selection relating data producing section

116 packet demultiplexing section

117 first replace PID storing device

119 PID filter

122 stream sending section

124 second replace PID storing device

126 SIT packet replacing device

128 PID designating section

129 packet modifying section

151 digital broadcasting system

153 reception system

166 packet demultiplexing section

169 PID filter

172 stream sending section

176 SIT packet replacing device

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, embodiments of the invention will be described with reference to the accompanying drawings.

(Embodiment 1)

First, the configuration of a digital broadcasting system of Embodiment 1 will be described with reference to Fig. 1. Fig. 1 is a diagram showing the configuration of a digital broadcasting system 1 of Embodiment 1.

The digital broadcasting system 1 comprises a transmission system 2 which produces and transmits a transport stream, and a reception system 3 which receives the transport stream and outputs it to a display device 4 or a recording device 5. A satellite transponder 6 is a device which relays a radio wave, and mounted in a communication satellite 7.

Next, the configuration of the transmission system 2 in Embodiment 1 will be described with reference to Fig. 2. Fig. 2 is a diagram showing the configuration of the transmission system 2 in Embodiment 1.

The transmission system 2 has a program selection relating data producing section 9, a packet multiplexing section 10, etc.

A coding section 8 has an MPEG2 video encoder which performs digital video compression coding, and an MPEG2 audio encoder which performs digital audio compression coding. Namely, the coding section 8 produces a packet stream consisting of packets having contents of a program, and outputs the packet stream to the packet multiplexing section 10.

The program selection relating data producing section 9 produces a packet stream consisting of a packet having program specific information, a packet having service information, and program dummy packets, and outputs the packet stream to the packet multiplexing section 10. Furthermore, also a packet having data for previously notifying the program dummy packets to the reception system 3 is produced by the program selection relating

data producing section 9, and then output to the packet multiplexing section 10. Also the PIDs of the program dummy packets are designated by a PMT in the same manner as the PIDs of data constituting a program. In this way, the program selection relating data producing section 9 produces a packet stream consisting of packets having contents of program selection relating data, and outputs the packet stream to the packet multiplexing section 10.

The packet multiplexing section 10 time division multiplexes the packet stream consisting of packets having contents of a program and supplied from the coding section 8, and that consisting of packets having contents of program selection relating data and supplied from the program selection relating data producing section 9, into one transport stream.

A channel coding section 11 adds an error correcting code to the transport stream supplied from the packet multiplexing section 10, and performs an interleave process, and addition of a synchronizing signal.

A modulating section 12 modulates the transport stream supplied from the channel coding section 11, and transmits a radio wave 47 from an antenna.

Next, the configuration of the reception system 3 in Embodiment 1 will be described in detail with reference to Fig. 3. Fig. 3 is a diagram showing the configuration of the reception system 3 in Embodiment 1.

The reception system 3 has a packet demultiplexing section 16, a stream sending section 22, etc.

A receiving section 13 receives a radio wave 48 which is transmitted from the satellite transponder 6 (shown in Fig. 1).

A demodulating section 14 has a detector circuit which demodulates the radio wave 48.

A channel decoding section 15 restores the transport stream which has undergone the interleave process in the channel coding section 11, to the original transport stream, and performs error correction on the restored transport stream.

The packet demultiplexing section 16 has a PID filter 19, etc.

A PID designating section 28 can designate the PID of a dummy packet for a record program (hereinafter, often referred to as record program dummy PID), to a first replace PID storing device 17 and a second replace PID storing device 24. As described later, a record program is a program which is selected by external instructions.

The first replace PID storing device 17 receives a signal from the PID designating section 28, and stores the record program dummy PID. The record program dummy PID stored in the first replace PID storing device 17 is identical with the record program dummy PID stored in the second replace PID storing device 24.

The record PID storing device 18 receives a signal from the PID designating section 28, and stores the PID of a packet

having contents of a record program.

The PID filter 19 extracts a packet having contents of a record program which is indicated by the record PID storing device 18, a record program dummy packet which is indicated by the first replace PID storing device 17, a packet having program specific information, and a packet having service information, from a transport stream which is supplied from the channel decoding section 15. However, the PID filter 19 has a function of allowing the packet having program specific information, and the packet having service information to pass therethrough without applying any process on the packets.

An output switching circuit 20 switches over the transport stream which is supplied from the PID filter 19, to an output for displaying or that for recording.

An SIT producing section 21 produces an SIT packet from the SDT or the EIT which is output from the PID filter 19.

The stream sending section 22 has an SIT packet replacing device 26, etc.

An NIT PID storing device 23 receives a signal from the PID designating section 28, and stores the NIT PID.

The second replace PID storing device 24 receives a signal from the PID designating section 28, and stores the record program dummy PID. The record program dummy PID stored in the second replace PID storing device 24 is identical with the record program dummy PID stored in the first replace PID storing device 17.

An SIT storing device 25 stores the SIT packet which is produced by the SIT producing section 21.

The SIT packet replacing device 26 can replace an NIT packet which is indicated by the NIT PID storing device 23, and the record program dummy packet indicated by the second replace PID storing device 24, with the SIT packet which is output from the SIT storing device 25.

A packet modifying section 29 can receive a signal which is output from the SIT packet replacing device 26, and modify a packet to produce a record transport stream. The produced transport stream is output to the recording device 5.

A decoding section 27 has an MPEG2 video decoder which expands a compression coded video signal supplied from the output switching circuit 20, and an MPEG2 audio decoder which expands a compression coded audio signal supplied from the output switching circuit 20. Namely, the decoding section 27 expands a display transport stream which has compression coded contents of a program, and outputs the expanded stream to the display device 4.

The operation of the thus configured digital broadcasting system 1 of Embodiment 1 will be described with reference to Fig. 4 also. Fig. 4 is a conceptual diagram illustrating steps of producing a record transport stream 46 from a transport stream 44 which is broadcast, via a transport stream 45 which is processed in the packet demultiplexing section 16.

Hereinafter, the operation of the transmission system 2 in Embodiment 1 will be described in detail with reference to Figs. 2 and 4.

The coding section 8 produces a packet stream consisting of packets 30 and 38 having contents of a program A, and a packet stream consisting of a packet 31 having contents of a program B, and outputs the packet streams to the packet multiplexing section 10.

The program selection relating data producing section 9 produces a packet stream consisting of a PAT packet 32, a PMT packet 37, an NIT packet 34, an SDT packet 36, an EIT packet 33, a dummy packet 39 for the program A, and a dummy packet 35 for the program B, and outputs the packet stream to the packet multiplexing section 10.

The packet multiplexing section 10 multiplexes the packet stream supplied from the coding section 8, and the packet stream supplied from the program selection relating data producing section 9, to produce the transport stream 44. The transport stream is then output to the channel coding section 11.

The channel coding section 11 performs addition of an error correcting code, an interleave process, and addition of a synchronizing signal on the transport stream 44 supplied from the packet multiplexing section 10, and then outputs the transport stream to the modulating section 12.

The modulating section 12 applies a modulation process

due to quadrature phase shift keying modulation, on the transport stream supplied from the channel coding section 11, and transmits the radio wave 47 from the antenna.

The satellite transponder 6 (shown in Fig. 1) receives the radio wave 47 (shown in Fig. 1), and then transmits the radio wave 48 (shown in Fig. 1).

Next, the operation of the reception system 3 in Embodiment 1 will be described in detail with reference to Figs. 3 and 4.

In response to external instructions, the reception system 3 selects the program A as a record program in Embodiment 1 to start the receiving operation. Specifically, the reception system 3 receives the radio wave 48 from the satellite transponder 6, and refers information in the PAT in the transport stream of the radio wave, to detect the PMT. The PID designating section 28 recognizes the PID of the record program dummy packet 39, and performs a signal output to the first replace PID storing device 17 and the second replace PID storing device 24. The PID designating section 28 performs also a signal output to the record PID storing device 18 and the NIT PID storing device 23.

The record PID storing device 18 receives the signal from the PID designating section 28, and stores the PIDs of the packets 30 and 38 having contents of the program A. The first replace PID storing device 17 receives the signal from the PID designating section 28, and stores the PID of the dummy packet 39 for the program A. The NIT PID storing device 23 receives the signal

from the PID designating section 28, and stores the PID of the NIT packet 34. The second replace PID storing device 24 receives the signal from the PID designating section 28, and stores the PID of the dummy packet 39 for the program A.

The receiving section 13 receives the radio wave 48, and then outputs the radio wave to the demodulating section 14.

The demodulating section 14 outputs the transport stream which is obtained by demodulating the radio wave 48 received by the receiving section 13, to the channel decoding section 15.

The channel decoding section 15 performs error correction on the transport stream supplied from the demodulating section 14, restores the transport stream 44, and outputs the restored transport stream to the PID filter 19.

As described above, the record PID storing device 18 stores the PIDs of the packets 30 and 38 having contents of the program A. The first replace PID storing device 17 stores the PID of the dummy packet 39 for the program A, as a replace PID.

Therefore, the record PID storing device 18 can indicate the packets 30 and 38 having contents of the program A, to the PID filter 19. The first replace PID storing device 17 can indicate the dummy packet 39 for the program A, to the PID filter 19.

The PID filter 19 extracts the packets 30 and 38 having contents of the program A which are indicated by the record PID storing device 18, and the dummy packet 39 for the program A which

is indicated by the first replace PID storing device 67, from the transport stream 44 output from the channel decoding section 15. Furthermore, the PID filter 19 extracts the PAT packet 32, the PMT packet 37, the NIT packet 34, the SDT packet 36, and the EIT packet 33 from the transport stream 44 output from the channel decoding section 15.

The PID filter 19 then outputs the SDT and the EIT to the SIT producing section 21. Furthermore, the PID filter 19 outputs to the output switching circuit 20 the transport stream 45 consisting of the packets 30 and 38 having contents of the program A, the dummy packet 39 for the program A, the PAT packet 32, the PMT packet 37, the NIT packet 34, the SDT packet 36, and the EIT packet 33.

The SIT producing section 21 receives the SDT and the EIT supplied from the PID filter 19, produces SIT packets 41 and 43, and outputs the SIT packets to the SIT storing device 25. The SIT storing device 25 outputs the SIT packets 41 and 43 supplied from the SIT producing section 21, to the SIT packet replacing device 26.

The output switching circuit 20 receives the transport stream 45 supplied from the PID filter 19.

If the output switching circuit 20 is set to the output for displaying, the output switching circuit 20 outputs the display transport stream to the decoding section 27.

The decoding section 27 expands the display transport

stream supplied from the output switching circuit 20, and outputs a signal of the expanded stream to the display device 4.

The display device 4 receives the signal output from the decoding section 27, and displays an image and a sound constituting the program A.

If the output switching circuit 20 is set to the output for recording, the output switching circuit 20 outputs the transport stream 45 to the SIT packet replacing device 26.

As described above, the NIT PID storing device 23 stores the PID of the NIT packet 34, and the second replace PID storing device 24 stores the PID of the dummy packet 39 for the program A.

Therefore, the NIT PID storing device 23 can indicate the NIT packet 34 to the SIT packet replacing device 26. The second replace PID storing device 24 can indicate the dummy packet 39 for the program A to the SIT packet replacing device 26.

The SIT packet replacing device 26 receives the transport stream 45 supplied from the output switching circuit 20. The SIT packet replacing device 26 replaces the NIT packet 34 indicated by the NIT PID storing device 23, with the SIT packet 41 supplied from the SIT storing device 25. The SIT packet replacing device 26 replaces the dummy packet 39 for the program A indicated by the second replace PID storing device 24, with the SIT packet 43 supplied from the SIT storing device 25.

In this way, the SIT packet replacing device 26 performs

replacement of the NIT packet 34 with the SIT packet 41, and that of the dummy packet 39 for the program A with the SIT packet 43, and then outputs the signals to the packet modifying section 29.

The packet modifying section 29 receives the signals output from the SIT packet replacing device 26, and selects only specific information which correctly indicates the transport stream 45, whereby the PAT packet 32 is modified to a modified PAT packet 40, and the PMT packet 37 is modified to a modified PAT packet 42. The packet modifying section 29 discards the SDT packet 36 and the EIT packet 33. In this way, the packet modifying section 29 produces a record transport stream 46, and outputs the stream to the recording device 5.

The recording device 5 receives the record transport stream 46 supplied from the packet modifying section 29, and records the transport stream.

In the invention, the PIDs of program dummy packets are not required to be designated by the PMT as in Embodiment 1 described above, and may be described as descriptors in a descriptor region of the SDT or the EIT.

As described above, the problem in that the transmission interval of an NIT packet as a replace packet is insufficient is solved by sending program dummy packets which are replaceable with an SIT packet, from the transmission system.

(Embodiment 2)

First, the configuration of a digital broadcasting system

of Embodiment 2 will be described with reference to Fig. 5. Fig. 5 is a diagram showing the configuration of a digital broadcasting system 51 of Embodiment 2.

The digital broadcasting system 51 comprises a transmission system 52 which produces and transmits a transport stream, and a reception system 53 which receives the transport stream and outputs it to a display device 4 or a recording device 5.

Next, the configuration of the transmission system 52 in Embodiment 2 will be described.

The transmission system 52 has a program selection relating data producing section 59, a packet multiplexing section 10, etc.

The program selection relating data producing section 59 produces a packet stream consisting of a packet having program specific information, and a packet having service information, and outputs the packet stream to the packet multiplexing section 10. Furthermore, also a packet having an SIT record interval data instructing an appropriate record interval for the SIT is produced by the program selection relating data producing section 59, and then output to the packet multiplexing section 10. The SIT record interval data instructing an appropriate record interval for the SIT is described as a descriptor in a descriptor region of the SDT or the EIT.

Next, the configuration of the reception system 53 in Embodiment 2 will be described.

The reception system 53 has a packet demultiplexing section 66, a stream sending section 72, etc.

The packet demultiplexing section 66 has a PID filter 69, etc.

A PID designating section 78 can designate the PID of a packet having contents of an unrecord program (hereinafter, often referred to as unrecord PID), to a first replace PID storing device 67 and a second replace PID storing device 74, with reference to the SIT record interval data which is output from the program selection relating data producing section 59.

The first replace PID storing device 67 receives a signal from the PID designating section 78, and stores the unrecord PID. The unrecord PID stored in the first replace PID storing device 67 is identical with the unrecord PID stored in the second replace PID storing device 74.

The PID filter 69 extracts a packet having contents of a record program which is indicated by a record PID storing device 18, a packet having contents of the unrecord program which is indicated by the first replace PID storing device 67, a packet having program specific information, and a packet having service information, from a transport stream which is supplied from a channel decoding section 15.

The stream sending section 72 has an SIT packet replacing device 76, etc.

The second replace PID storing device 74 receives a signal

from the PID designating section 78, and stores the unrecord PID. The unrecord PID stored in the second replace PID storing device 74 is identical with the unrecord PID stored in the first replace PID storing device 67.

The SIT packet replacing device 76 can replace an NIT packet which is indicated by an NIT PID storing device 23, and the packet having contents of the unrecord program indicated by the second replace PID storing device 74, with the SIT packet which is output from an SIT storing device 25.

The operation of the thus configured digital broadcasting system 51 of Embodiment 2 will be described with reference to Fig. 6 also. Fig. 6 is a conceptual diagram illustrating steps of producing a record transport stream 96 from a transport stream 94 which is broadcast, via a transport stream 95 which is processed in the packet demultiplexing section 66.

Hereinafter, the operation of the transmission system 52 in Embodiment 2 will be described in detail.

A coding section 8 produces a packet stream consisting of packets 80 and 88 having contents of a program A, and a packet stream consisting of packets 81, 85, and 89 having contents of a program B, and outputs the packet streams to the packet multiplexing section 10.

The program selection relating data producing section 59 produces a packet stream consisting of a PAT packet 82, a PMT packet 87, an NIT packet 84, an SDT packet 86, and an EIT packet

83, and outputs the packet stream to the packet multiplexing section 10.

The packet multiplexing section 10 multiplexes the packet stream supplied from the coding section 8, and the packet stream supplied from the program selection relating data producing section 59, to produce the transport stream 94. The transport stream is then output to a channel coding section 11.

The channel coding section 11 performs addition of an error correcting code, an interleave process, and addition of a synchronizing signal on the transport stream supplied from the packet multiplexing section 10, and then outputs the transport stream to a modulating section 12.

The modulating section 12 modulates the transport stream supplied from the channel coding section 11, and transmits a radio wave 97.

A satellite transponder 6 receives the radio wave 97, and then transmits a radio wave 98.

Next, the operation of the reception system 53 in Embodiment 2 will be described in detail.

In response to external instructions, the reception system 53 selects the program A as a record program in Embodiment 2 to start the receiving operation. Specifically, the reception system 53 receives the radio wave 98 from the satellite transponder 6, and refers information in the PAT in the transport stream of the radio wave, to detect the PMT. The PID designating section

78 refers the SIT record interval data supplied from the program selection relating data producing section 59 to appropriately recognize the PID of the packet 85 having contents of the program B which is an unrecord program, and performs a signal output to the first replace PID storing device 67 and the second replace PID storing device 74. The PID designating section 78 performs also a signal output to the record PID storing device 18 and the NIT PID storing device 23.

The record PID storing device 18 receives the signal from the PID designating section 78, and stores the PIDs of the packets 80 and 88 having contents of the program A. The first replace PID storing device 67 receives the signal from the PID designating section 78, and appropriately stores the PID of the packet 85 having contents of the program B which is an unrecord program. The NIT PID storing device 23 receives the signal from the PID designating section 78, and stores the PID of the NIT packet 84. The second replace PID storing device 74 receives the signal from the PID designating section 78, and appropriately stores the PID of the packet 85 having contents of the program B.

As a result of the reference to the SIT record interval data, the PID designating section 78 does not designate the PIDs of the packets 81 an 89 having contents of the program B, as a replace PID. Therefore, the PIDs of the packets 81 an 89 having contents of the program B are not stored into the first replace PID storing device 67, and the PIDs of the packets 81 an 89 having

contents of the program B are not stored into the second replace PID storing device 74.

The receiving section 13 receives the radio wave 98, and then outputs the radio wave to a demodulating section 14.

The demodulating section 14 outputs the transport stream which is obtained by demodulating the radio wave 98 received by the receiving section 13, to the channel decoding section 15.

The channel decoding section 15 performs error correction on the transport stream supplied from the demodulating section 14, restores the transport stream 94, and outputs the restored transport stream to the PID filter 69.

As described above, the record PID storing device 18 stores the PIDs of the packets 80 and 88 having contents of the program A. The first replace PID storing device 67 appropriately stores the PID of the packet 85 having contents of the program B which is an unrecord program, as a replace PID (the PIDs of the packets 81 an 89 having contents of the program B are not designated as a replace PID).

Therefore, the record PID storing device 18 can indicate the packets 80 and 88 having contents of the program A, to the PID filter 69. The first replace PID storing device 67 can indicate the packet 85 having contents of the program B, to the PID filter 69.

The PID filter 69 extracts the packets 80 and 88 having contents of the program A which are indicated by the record PID

storing device 18, and the packet 85 having contents of the program B which is indicated by the first replace PID storing device 67, from the transport stream 94 output from the channel decoding section 65. Furthermore, the PID filter 69 extracts the PAT packet 82, the PMT packet 87, the NIT packet 84, the SDT packet 86, and the EIT packet 83 from the transport stream 94 output from the channel decoding section 15.

The PID filter 69 then outputs the SDT and the EIT to an SIT producing section 21. Furthermore, the PID filter 69 outputs to an output switching circuit 20 the transport stream 95 consisting of the packets 80 and 88 having contents of the program A, the packet 85 having contents of the program B, the PAT packet 82, the PMT packet 87, the NIT packet 84, the SDT packet 86, and the EIT packet 83.

The SIT producing section 21 receives the SDT and the EIT supplied from the PID filter 69, produces SIT packets 91 and 92, and outputs the SIT packets to the SIT storing device 25. The SIT storing device 25 outputs the SIT packets 91 and 92 supplied from the SIT producing section 21, to the SIT packet replacing device 76.

The output switching circuit 20 receives the transport stream 95 supplied from the PID filter 69.

If the output switching circuit 20 is set to the output for displaying, the output switching circuit 20 outputs the display transport stream to a decoding section 27. The decoding

section 27 expands the display transport stream supplied from the output switching circuit 20, and outputs a signal of the expanded stream to the display device 4.

The display device 4 receives the signal output from the decoding section 27, and reproduces an image and a sound constituting the program A.

If the output switching circuit 20 is set to the output for recording, the output switching circuit 20 outputs the transport stream 95 to the SIT packet replacing device 76.

As described above, the NIT PID storing device 23 stores the PID of the NIT packet 84, and the second replace PID storing device 74 appropriately stores the PID of the packet 85 having contents of the program B.

The SIT packet replacing device 76 receives the transport stream 95 supplied from the output switching circuit 20. The SIT packet replacing device 76 replaces the NIT packet 84 indicated by the NIT PID storing device 23, with the SIT packet 91 supplied from the SIT storing device 25. Furthermore, the SIT packet replacing device 76 replaces the packet 85 having contents of the program B which is indicated by the second replace PID storing device 74, with the SIT packet 92 supplied from the SIT storing device 25.

In this way, the SIT packet replacing device 76 performs replacement of the NIT packet 84 with the SIT packet 91, and that of the packet 85 having contents of the program B with the SIT

packet 92, and then outputs the signals to a packet modifying section 29.

The packet modifying section 29 receives the signals output from the SIT packet replacing device 76, and modifies the PAT packet 82 to a modified PAT packet 90, and the PMT packet 87 to a modified PAT packet 93. The packet modifying section 29 discards the SDT packet 86 and the EIT packet 83. In this way, the packet modifying section 29 produces a record transport stream 96, and outputs the stream to the recording device 5.

The recording device 5 receives the record transport stream 96 supplied from the packet modifying section 29, and records the transport stream.

In the invention, the replace PID is not required to be the whole of or a part of an unrecord PID as in Embodiment 2 described above, and may be the SDT PID, or the EIT PID.

The problem in that the transmission interval of an NIT packet as a replace packet is insufficient is solved by sending an SIT record interval data instructing an appropriate record interval for the SIT, and using a packet having contents of an unrecord program as a replace packet which is replaceable with an SIT packet.

(Embodiment 3)

First, the configuration of a digital broadcasting system of Embodiment 3 will be described with reference to Fig. 7. Fig. 7 is a diagram showing the configuration of a digital broadcasting

system 101 of Embodiment 3.

The digital broadcasting system 101 comprises a transmission system 102 which produces and transmits a transport stream, and a reception system 103 which receives the transport stream and outputs it to a display device 4 or a recording device 5.

The transmission system 102 in Embodiment 3 is identical with the transmission system described in the paragraph of the conventional art.

The configuration of the reception system 103 in Embodiment 3 will be described with reference to Fig. 7.

The reception system 103 has a packet demultiplexing section 116, a stream sending section 122, etc.

The packet demultiplexing section 116 has a PID filter 119, etc.

A PID designating section 128 can designate the PID of a packet having contents of an unrecord program (hereinafter, often referred to as unrecord PID), and the EIT PID (i.e., the PID of the EIT packet), to a first replace PID storing device 117 and a second replace PID storing device 124.

The first replace PID storing device 117 receives a signal from the PID designating section 128, and stores the unrecord PID and the EIT PID. The unrecord PID and the EIT PID stored in the first replace PID storing device 117 are identical with the unrecord PID and the EIT PID stored in the second replace

PID storing device 124.

The PID filter 119 extracts a packet having contents of a record program which is indicated by a record PID storing device 18, a packet having contents of the unrecord program which is indicated by the first replace PID storing device 117, an EIT packet which is indicated by the first replace PID storing device 117, a packet having program specific information, and a packet having service information, from a transport stream which is supplied from a channel decoding section 15.

The stream sending section 122 has an SIT packet replacing device 126, etc.

The second replace PID storing device 124 receives a signal from the PID designating section 128, and stores the unrecord PID and the EIT PID. The unrecord PID and the EIT PID stored in the second replace PID storing device 124 are identical with the unrecord PID and the EIT PID stored in the first replace PID storing device 117.

The SIT packet replacing device 126 can replace an NIT packet which is indicated by an NIT PID storing device 23, the packet having contents of the unrecord program indicated by the second replace PID storing device 124, and an EIT packet which is indicated by the second replace PID storing device 124, with an SIT packet which is output from an SIT storing device 25.

The packet modifying section 129 receives the signals output from the SIT packet replacing device 126, and modifies

the packet to produce a record transport stream.

The operation of the thus configured digital broadcasting system 101 of Embodiment 3 will be described with reference to Fig. 8 also. Fig.8 is a conceptual diagram illustrating steps of producing a record transport stream 146 from a transport stream 144 which is broadcast, via a transport stream 145 which is processed in the packet demultiplexing section 116.

The transmission system 102 in Embodiment 3 operates in the same manner as the transmission system described in the paragraph of the conventional art.

The operation of the reception system 103 in Embodiment 3 will be described in detail.

In response to external instructions, the reception system 103 selects a program A as a record program in Embodiment 3 to start the receiving operation. Specifically, the reception system 103 receives the radio wave 148 from the satellite transponder 6, and refers information in the PAT in the transport stream of the radio wave, to detect the PMT. The PID designating section 128 recognizes the PIDs of the packets 131, 135, and 139 having contents of a program B which is an unrecord program, and the EIT packet 133, and performs a signal output to the first replace PID storing device 117 and the second replace PID storing device 124. The PID designating section 128 performs also a signal output to the record PID storing device 18 and the NIT PID storing device 23.

The record PID storing device 18 receives the signal from the PID designating section 128, and stores the PIDs of the packets 130 and 138 having contents of the program A. The first replace PID storing device 117 receives the signal from the PID designating section 128, and stores the PIDs of the packets 131, 135, and 139 having contents of the program B, and the PID of the EIT packet 133. The NIT PID storing device 23 receives the signal from the PID designating section 128, and stores the PID of the NIT packet 134. The second replace PID storing device 124 receives the signal from the PID designating section 128, and stores the PIDs of the packets 131, 135, and 139 having contents of the program B, and the PID of the EIT packet 133.

The receiving section 13 receives the radio wave 148, and then outputs the radio wave to a demodulating section 14.

The demodulating section 14 outputs the transport stream which is obtained by demodulating the radio wave 148 received by the receiving section 13, to the channel decoding section 15.

The channel decoding section 15 performs error correction on the transport stream supplied from the demodulating section 14, restores the transport stream 144, and outputs the restored transport stream to a PID filter 119.

The PID filter 119 extracts the packets 130 and 138 having contents of the program A which are indicated by the record PID storing device 18, the PIDs of the packets 131, 135, and 139 having contents of the program B which are indicated by the first replace

PID storing device 117, and the EIT packet 133 which is indicated by the first replace PID storing device 117, from the transport stream 144 output from the channel decoding section 15. Furthermore, the PID filter 119 extracts the PAT packet 132, the PMT packet 137, the NIT packet 134, the SDT packet 136, and the EIT packet 133 from the transport stream 144 output from the channel decoding section 15.

The PID filter 119 then outputs the SDT and the EIT to an SIT producing section 21. Furthermore, the PID filter 119 outputs to the output switching circuit 20 the transport stream 145 consisting of the packets 130 and 138 having contents of the program A, the packets 131, 135, and 139 having contents of the program B, the PAT packet 132, the PMT packet 137, the NIT packet 134, the SDT packet 136, and the EIT packet 133.

The SIT producing section 21 receives the SDT and the EIT supplied from the PID filter 119, produces SIT packets 141 and 142, and outputs the SIT packets to the SIT storing device 25. The SIT storing device 25 outputs the SIT packets 141 and 142 supplied from the SIT producing section 21, to the SIT packet replacing device 126.

The output switching circuit 20 receives the transport stream 145 supplied from the PID filter 119.

If the output switching circuit 20 is set to the output for displaying, the output switching circuit 20 outputs the display transport stream to the decoding section 27.

The decoding section 27 expands the display transport stream supplied from the output switching circuit 20, and outputs a signal of the expanded stream to the display device 4.

The display device 4 receives the signal output from the decoding section 27, and displays an image and a sound constituting the program A.

If the output switching circuit 20 is set to the output for recording, the output switching circuit 20 outputs the transport stream 145 to the SIT packet replacing device 126.

The SIT packet replacing device 126 receives the transport stream 145 supplied from the output switching circuit 20. The SIT packet replacing device 126 determines whether the NIT packet 134, the packets 131, 135, and 139 having contents of the program B, and the EIT packet 133 are actually replaced with the SIT packets 141 and 142 or not.

Specifically, the SIT packet replacing device 126 replaces the NIT packet 134 indicated by the NIT PID storing device 23, with the SIT packet 141 supplied from the SIT storing device 25. The SIT packet replacing device 126 replaces the EIT packet 133 indicated by the second replace PID storing device 124, with the SIT packet 142 supplied from the SIT storing device 25. The SIT packet replacing device 126 does not replace the packets 131, 135, and 139 having contents of the program B with the SIT packet (as described above, the transmission interval of the EIT packet is sufficient, and hence a packet having contents of an unrecord

program is not sometimes used as a replace packet).

In this way, the SIT packet replacing device 126 performs replacement of the NIT packet 134 with the SIT packet 142, and that of the EIT packet 133 with the SIT packet 141, and then outputs the signals to the packet modifying section 129.

The packet modifying section 129 receives the signals output from the SIT packet replacing device 126, and modifies the PAT packet 132 to a modified PAT packet 140, and the PMT packet 137 to a modified PAT packet 143. The packet modifying section 129 discards the SDT packet 136, the EIT packet 133, and the packets 131, 135, and 139 having contents of the program B. In this way, the packet modifying section 129 produces a record transport stream 146, and outputs the stream to the recording device 5.

The recording device 5 receives the record transport stream 146 supplied from the packet modifying section 129, and records the transport stream.

In the invention, the SIT packet replacing device 126 is not required to replace properly replace packets which are adequately selected from a packet having a designated replace PID with SIT packets as in Embodiment 3 described above. Alternatively, replace packets which are selected at a predetermined ratio from all packets having a designated replace PID may be replaced with SIT packets.

As described above, the problem in that the transmission interval of an NIT packet as a replace packet is insufficient

is solved by providing the SIT packet replacing device with an ability of determining whether replacement with an SIT packet is actually performed or not, and using a packet having contents of an unrecord program, and an EIT packet as a replace packet which is replaceable with an SIT packet.

In the embodiments described above, a member in which the PID filter and the SIT packet replacing device are combined with each other corresponds to the packet extracting and replacing section of the invention.

In the invention, a packet stream is not required to be configured by ten packets as in the embodiments described above, and may be configured by any number of packets.

In the invention, it is not required that only two programs are broadcasting as in the embodiments described above, and any number of programs may be broadcast.

In the invention, it is not required to use two replace PID storing devices as in the embodiments described above, and only one replace PID storing device may be used.

In the invention, the digital broadcasting is not required to broadcasting which uses a communication satellite as in the embodiments described above, and may be cable broadcasting which uses an optical fiber or a coaxial cable, or radio broadcasting.

In the invention, the digital broadcasting is not required to broadcasting of programs as in the embodiments described above, and may be broadcasting of computer games or karaoke.

As apparent from the above description, ~~the first invention corresponding to claim 1 can provide~~ a reception system in which a replace packet that is replaceable with an SIT packet can be ~~certainly ensured~~ Provided.

~~The second invention corresponding to claim 2 can provide~~ A a reception system in which, in addition to the above-mentioned effect, replace packets for programs can be ~~ensured~~ Provided.

~~The third invention corresponding to claim 3 can provide~~ A a reception system in which, in addition to the above-mentioned effect, a replace packet can be ensured in response to instructions from a transmission system.

~~The fourth invention corresponding to claim 4 can provide~~ A a reception system in which, in addition to the above-mentioned effects, replace packets can be sufficiently ~~ensured~~ Provided in response to instructions from a transmission system.

~~The fifth invention corresponding to claim 5 can provide~~ A a reception system in which, in addition to the above-mentioned effect, a replace packet can be ~~ensured~~ Provided in accordance with a judgment of the reception system without the participation of a transmission system.

~~The sixth invention corresponding to claim 6 can provide~~ a a digital broadcasting system in which replace packets for programs can be certainly ~~ensured~~ Provided.

~~The seventh invention corresponding to claim 7 can provide~~ a a program recording medium which enables replace packets for

programs to be certainly Provided ~~ensured~~.